US Department of Energy
National Carbon Capture Center

Pre-Combustion CO_2 Capture Technology Developers

NETL CO2 Capture Technology Meeting

August 25, 2011

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National Carbon Capture Center

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Goals of the NCCC

- Offer a unique flexible testing facility where Technology Developers can scaleup their processes in an industrial setting using coal derived syngas.
- Serve as a technology development facilitator by providing facilities for the scale-up from bench-top to engineering-scale
- Solicit and incorporate activities and projects from a wide variety of participants and partners. Find "Best-in-class" Technology.
- Deliver innovation through a cross-cutting, collaborative project portfolio that provides an accelerated pathway to cost-effective CO_2 capture technology for coal fueled power production

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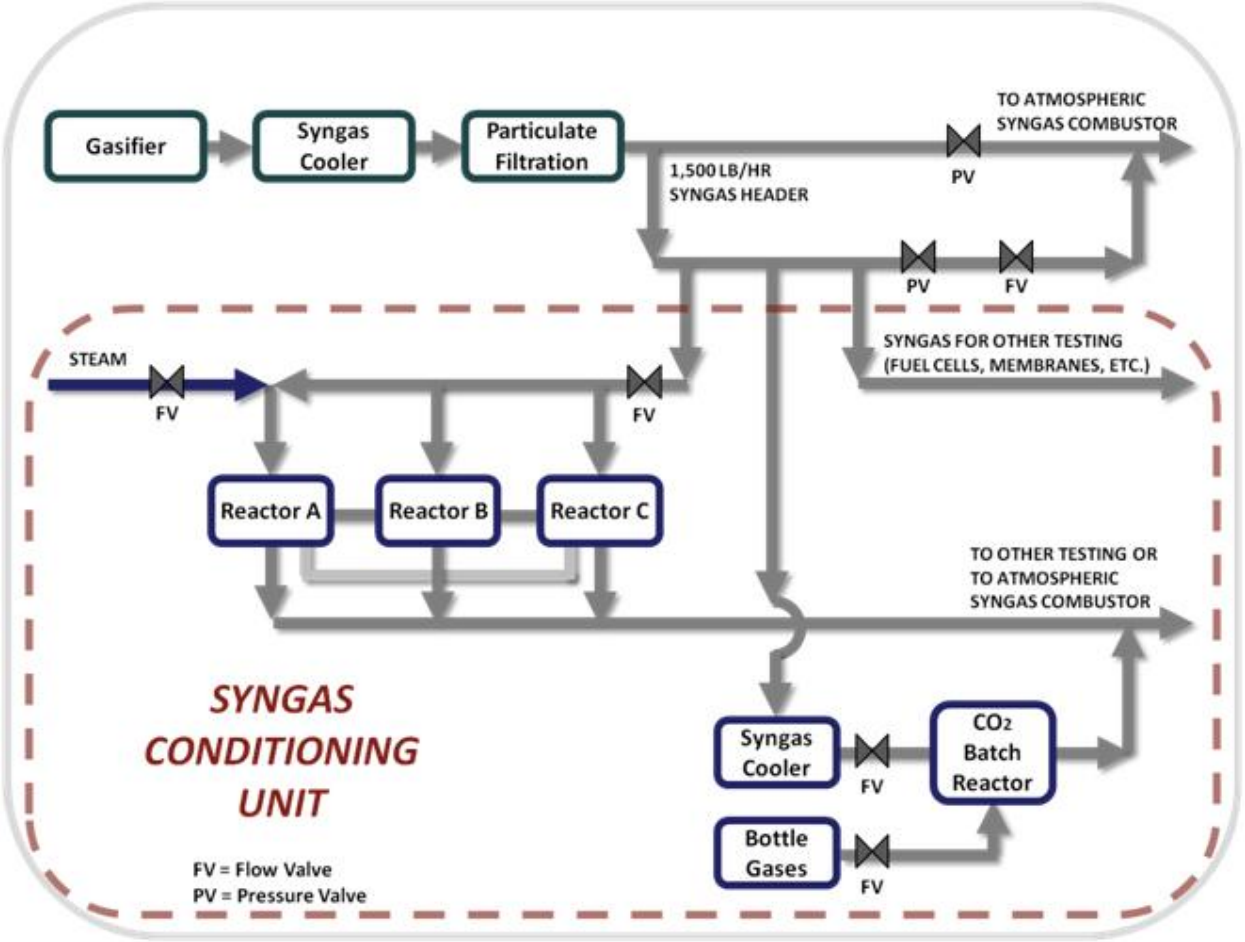
SCU Layout



Designed to provide hot, dust-free syngas in support of testing and scale up of developer's technologies:

- WGS catalysts
- CO_2 membranes
- H_2 membranes
- CO_2 adsorbents
- Chemical CO_2 solvents
- Physical CO_2 solvents
- Mercury sorbents
- Fuel cells
- Advanced instruments
- Chemical looping

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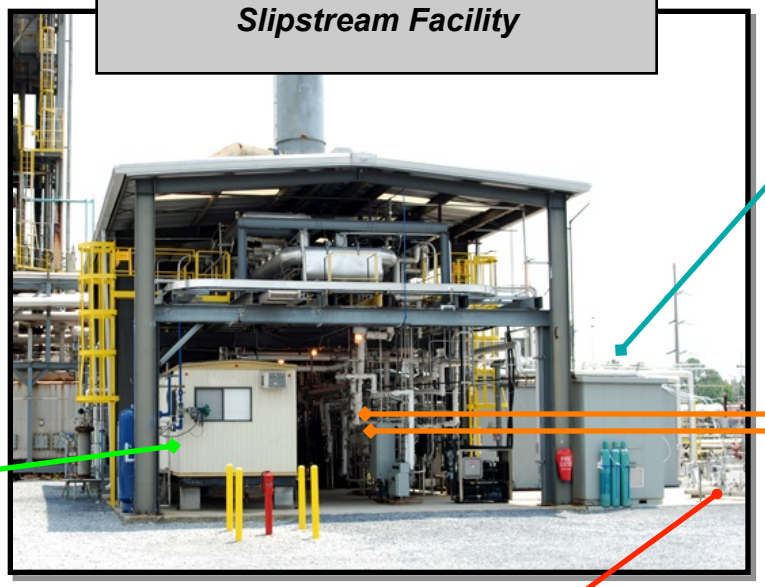
Pre-combustion Capture Projects

Adv. Solvent Test

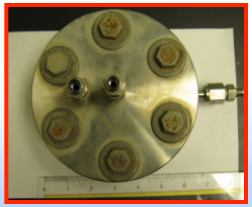
Slipstream Facility



Fuel Cell

WGS Catalyst

MTR

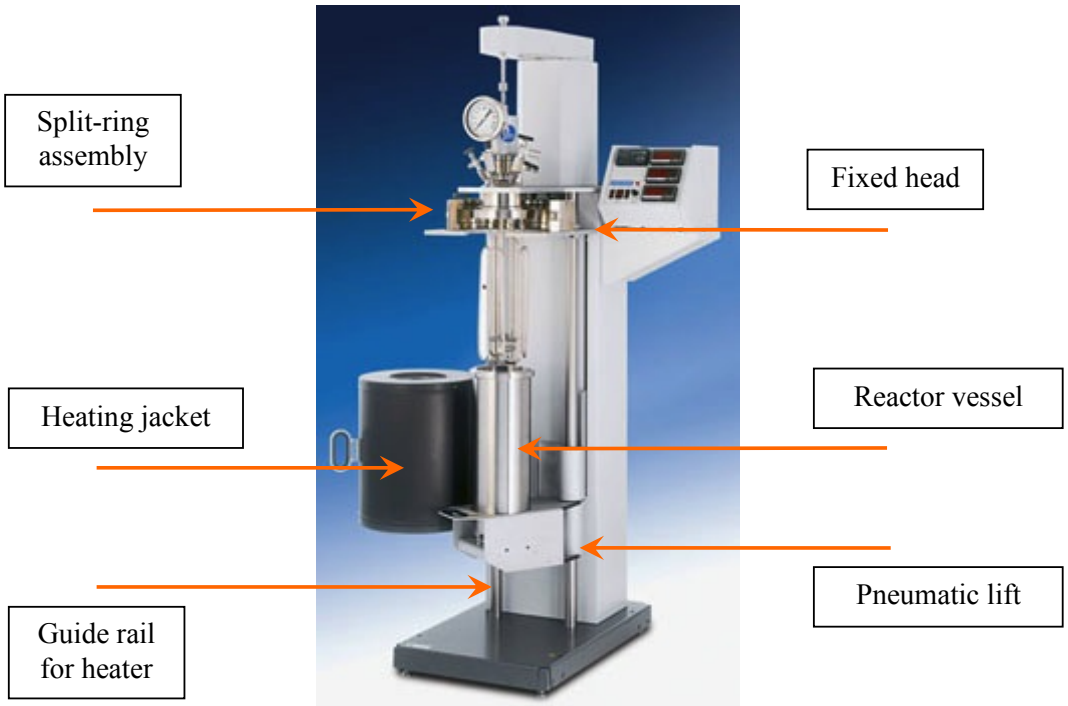


MPT

Hg Capture Sorbent (500 ºF)

Membrane Gas Separation (100-400 ˚F)

Parr Stirred Batch Reactor



Reactor: 17 inches tall x 6 inches ID, volume of 0.28 ft^3
Maximum operating conditions 1215 psia and 660ºF

- Chemical solvents tested are ammonia, potassium carbonate, and sodium prolinate (amino acid salt).
- Physical solvents tested are polydimethyl siloxane (PDMS), dimethyl ether of polyethylene glycol (DEPG) and glycerin triacetate (GTA).
- Physical solvents proposed by DOE based on tests at University of Pittsburgh.
- Preparing to test dimethyl carbonate

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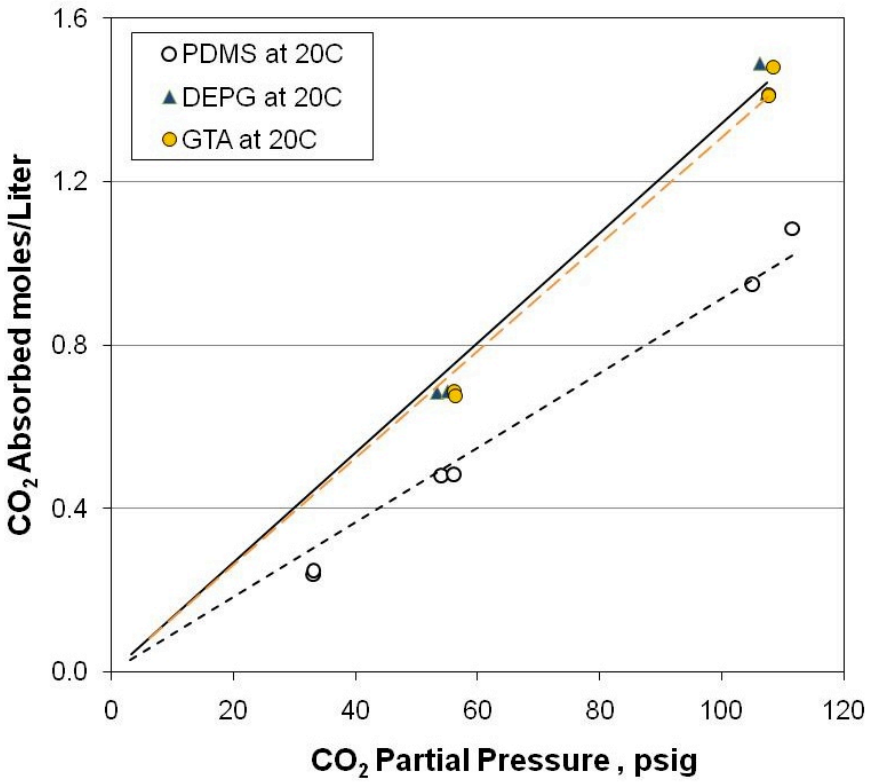
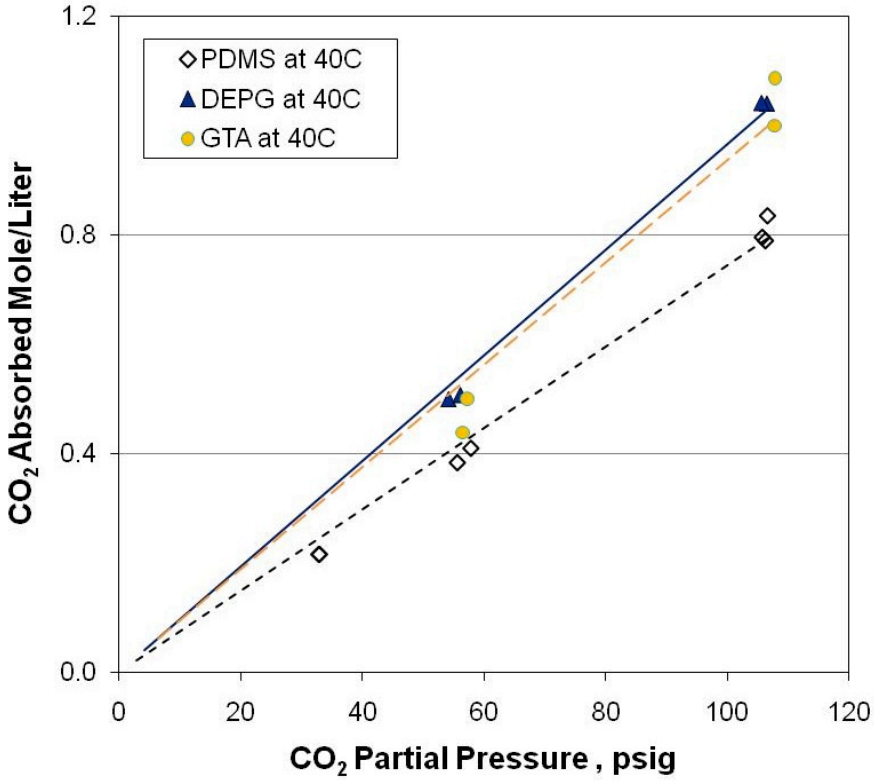
Effect of CO2 Partial Pressure on Absorption Capacity





- At 20°C, DEPG and GTA have similar CO_2 capacity and 40% more than PDMS.
- At 40°C, similar trends but CO_2 capacities all lower.

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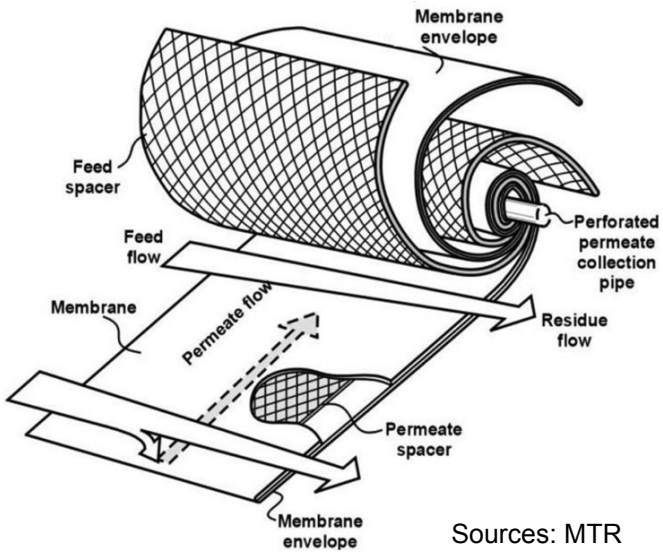
Membrane Technology & Research (MTR)
CO2 Membrane

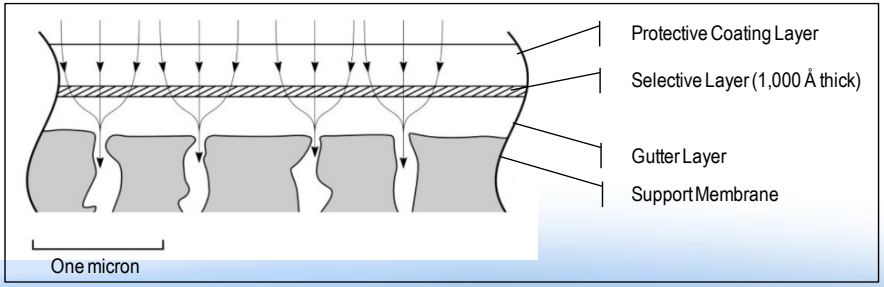
A Syngas inlet line B Permeate exit line
C Residual exit line



Sources: MTR

Spiral-wound design using polymer materials

- Over 1700 hours testing at 60 to100°F and 50 lb/hr syngas: sulfur tolerant.
- Preparing to support testing of 500 lb/ hr syngas CO_2 membrane.



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Summary of Pre-Combustion Testing

- Supporting developers in making transition from laboratory to commercial testing environment.
- Collecting and validating test data in support of scaling up developer's technologies.
- Continuing to seek opportunities to support development of emerging technologies and upgrading SCU infrastructure accordingly.

Frequently Asked Questions about Testing at the NCCC

- What does it cost to test at the NCCC?
  - Your people
  - Your solvent, plus disposal
  - Any major changes to the facility.
- What is the approval process?
  - Technology Collaboration Agreement

    Site access, IP provisions, division of responsibility
  - NETL approval of test plan

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Questions ?

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